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ABSTRACT

Information processing models indicate that learning occurs in the interaction of three systems: perceptual (receiving information), memory (selective storing of information), and performance (using the processed information). The three systems working together affect each other and together demonstrate learning. Reading, then, is the organization and reorganization of information and is never static. It is a creative and generative process that is learned by doing. The information processing model has implications for teaching reading for it demonstrates both the interdependence of all parts of the reading process and the idea that the driving force is for information. Reading is not a hierarchy of skills but an interaction of processes. Therefore, the teacher must be a facilitator providing appropriate material, a guided introduction to the traditions of written language, and an introduction to coding strategies without interfering with the reading process. The teacher's task is to provide order to bits of information and to develop confidence in a child to continue reading independently. (TJ)

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# INFORMATION PROCESSING AS A TOOL FOR SELECTING INSTRUCTIONAL STRATEGIES

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Information processing theories have motivated much of the current research in reading. A generation of scientists intrigued with cybernetics and the growth of computer technology has had a profound effect on cognitive psychology and the related field of psycholinguistics. As computer engineers attempt to teach computers to talk, psychologists and educators have hypothetically constructed the human mind with computer-like search strategies. The energetic pursuit of this sort of theory building led Hansen in 1971 to predict great success for the development of a complete model of the reading process with information processing concepts. In the 1970's, information processing models of reading have proliferated, and, at the same time, have become more and more complicated as a variety of reading processes have been hypothesized. Massaro (1975), in surveying the field, organized the then existing models into two categories: mediated models, those that sequence the processing stages from the printed page to meaning in the mind of the reader, and non-mediated models, those that propose the reader can go directly from visual features to meaning.

A simplified and generalized model of information

processing is being proposed here for the purpose of teacher education of reading. This proposed model retains the features of information processing models used in cognitive psychology (Norman & Rumelhart, 1970) and instructional theory (Gagne, 1974) while relating the concepts specifically to the ways in which meaning is extracted from text. Using the model, reading processes may be inferred and instructional strategies may be derived. The model is described as three interacting systems: the perceptual system, the memory system, and the performance system. The perceptual system receives sensory information; the memory system selectively stores information, and the performance system uses the processed information. Each of the three systems are dependent on the other two. Changes occur in each system as information is selected and processed. All three systems are influenced by affective variables, as every reader engages in reading with a mental set based on prior experiences, goals and values.

In the perceptual system, attention is directed to units or classes of information, that is letters, words, or semantic messages. The reader responds actively and intentionally, but is constrained by a knowledge of rule governed behavior, phonological, syntactical and lexical.

Developing readers become insightful perceivers with experience (Goodman, 1968). Units are perceived as classes in order to reduce the memory load in short-term memory (Smith, 1974). It is probable that viewers perceive three or four isolated letters or two or three short words in the same time frame (Geyer, 1968). Non-attention to units is necessary to attend to class. For example, it is not completely possible to attend to words if awareness is focused on letters (LaBorge & Samuels, 1974).

The memory system consists of long and short-term memory. Within the memory system, information is coded, stored and made available for retrieval. In short-term memory, awareness of data is either instantaneously lost, rehearsed while seeking some coding procedure, or incorporated into a conceptual schema. An example is of a reader who encounters the string c-h-a-i-r. If the letters are perceived as individual units, the image is either lost or rehearsed until organized by phonological rules. Once formed, the word chair may be lost or held by lexical recognition, or the reader may have attended to the semantics of the word chair as it fit the meaning of the entire message. Long-term memory is conceptualized as a reservoir of informational schemata in a state of flux (Norman & Rumelhart,1976).

Schemata enlarge by accruing new information. They are restructured and redefined when old schemata are unable to adjust to anomalies. On a phonological level, chair might not fit into any known vowel rule or recognized word family; a new vowel rule or word family might be needed to account for chair, flair and stair. On a lexical level, the connotation for chair might widen to include milking stool, or readjust to include presiding officer. Schemata affect the perceptual system by structuring the search strategies. The way in which the visual field is perceived (e.g., letters, words, or ideas) is determined by the ability of the memory system to code.

It is in the performance system that learning is demonstrated. All three systems, working as a whole, respond to the need to perform, that is in reading, to organize perceived information. Perceived information is organized in concepts. These concepts describe attributes of units and classes and designate labels for them. From a developmental perspective, concepts range from concrete to formal. A child cannot fully understand a "fork in the road" unless the physical shape of fork is understood. The level of concept attainment influences the reader's perception of distinctive features of units or the more generalized or

shared attributes of classes. The use of concepts is extended by deductive and inductive operations (Klausmeir, 1974). Referring once again to chair, chair may be generated by phonological rules, or by chair's relationship to Chip and stair, or because it is imbedded in The Three Bears. At the point of organization or during a learning period, a reader can describe how a word is generated. Once learned, the process defies reconstruction.

Reading, according to this model, is the organization and reorganization of information. This information is structured by rule governed behavior that is consistent with a reader's existing and changing conceptual framework. Reading, thereby, is never static; the quality changes as it proceeds. Readers, as information processors, approach the reading task purposefully. They bring to the act their needs, perspectives, language, and experience, but reading as an experience has the potential for expanding language, perspectives and redefining personal needs.

The model, as described, has implications for deriving a framework for reading instruction. It demonstrates an interdependence of all parts of the reading process. The driving force is the search for information. Reading instruction conceptualized as teaching a hierarchy of skills is

inconsistent with the model. As the purpose of reading is to find meaning, strategies for finding meaning must be built into reading instruction from the very beginning. Learning to read by isolating the parts, by first reading words, then sentences, then extracting some literal and inferential meaning, and, finally, making judgments about what is read, reverses the reading process. Children read for meaning because of some interest consistent with their purposes. Teaching children to read necessitates providing them with relevant and manageable materials keyed to their interests and then, providing them with whatever help necessary for them to extract appropriate meaning. In order to obtain meaning, they must learn to chunk the visual array so as not to overload the memory. If overload is experienced, meaning is lost.

A useful metaphor is teaching a child to ride a bicycle. The easiest way is not to have the child practice each maneuver separately, steering, pedaling, and balancing, but to place the child on an appropriately sized bike, run alongside while encouraging pedaling, steering and leaning in one direction or another or until the youngster takes off alone with some confidence. So in reading, the teacher must be a facilitator. Children enter school with a fund of experience and an expressive language. Their initial

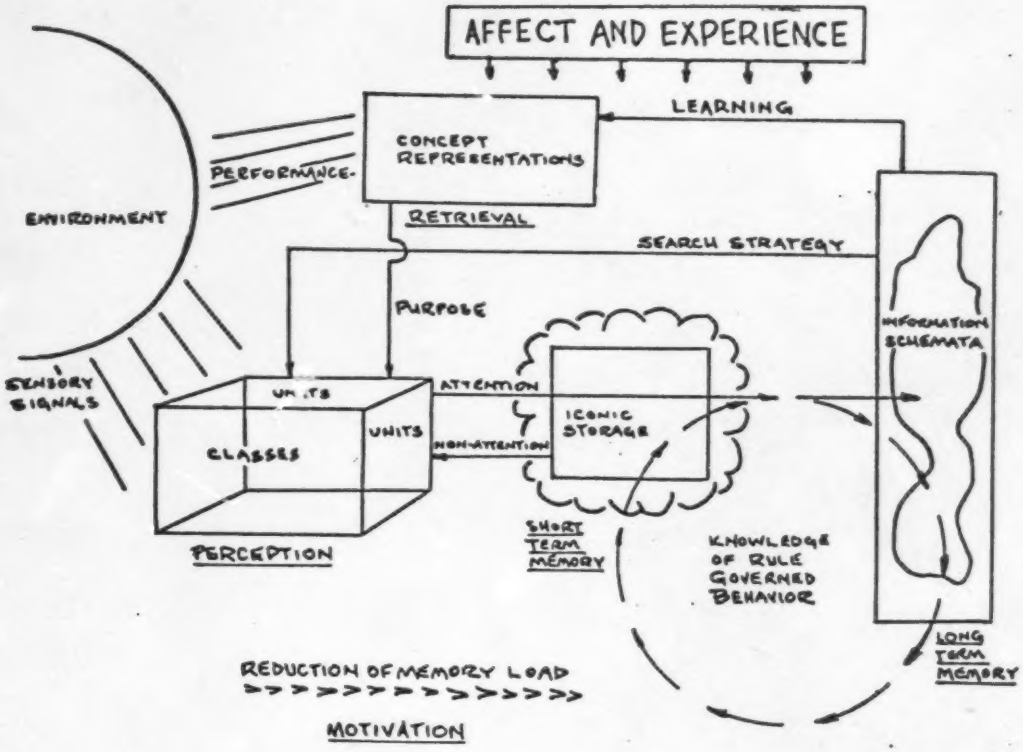
involvement with reading is inhibited by a limited ability to understand the coding system. To minimize the problem, appropriate material should draw from their experience and use their language. Initially, language experience stories and charts provide a guided introduction to the traditions of written language. Because coding is necessary to reduce the memory load, an appropriate time to introduce coding strategies is after a store of sight words is developed and some similarities amongst words are recognized. It is incumbent upon teachers to impose these coding strategies without interfering with the reading process. Frank Smith (1973) characterizes this interference as one of the ways of making learning to read difficult. If beginning materials are related to the learner's experience and language, the initial store of words are generated through context and consistent with oral speech patterns. The teacher's task becomes one of providing order to bits of information by eliciting heuristic strategies. As the reader gains experience, more and more opportunities for sustained reading must be provided. Each experience must be designed to develop confidence in a child to continue reading independently.

Meaningful reading parallels children's experience.

Concept attainment through reading is dependent upon children's concrete experiences in a stimulating learning environment. Linguistic competence grows through reading when children have the opportunity to share experiences. A curriculum tied to reading growth both encourages reading and increases knowledge if the teacher is a skilled observer of children. Being aware that each child is different is not enough. The problem is how is each child reacting qualitatively as interaction with materials proceeds? An analysis of errors, misunderstandings or "miscues" is a guide for teaching strategies. (Goodman & Burke, 1972). As a tool for selecting instructional strategies, the efficacy of an information processing model depends on a thorough knowledge of the learner as well as the process.

The human mind is not a computer, nor is reading a mechanical print-out of an information store. Reading is a creative and generative process not as yet fully understood. Further research into human intelligence will advance the knowledge of reading. For the present, an information processing model of reading provides a structure to accomodate the current theories of memory, cognition and perception and their relationship to reading. It provides a response for teacher educators faced with the question, "What

can I do tomorrow?" What is done in each school day depends upon deciding what information is desired, providing appropriate materials to satisfy the curiosity of each child, and helping to select and organize the desired information. An information processing model of reading is a model for learning to read by reading.

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